REDUCTION OF TAR AND NICOTINE IN TOBACCO SMOKING PRODUCTS

PM #662

Dr. R. B. Seligman and Mr. G. D. Keritsis have disclosed to me their invention which concerns improvements relating to reconstituted tobacco products. It is a method for lowering the amounts of total particulate matter and particularly the amounts of tar and nicotine in smoke from reconstituted tobacco products.

Abstract

The incorporation of heat-treated carbohydrate (HTC) into the matrix of reconstituted tobacco sheets prior to casting the sheet lowers the tar and nicotine content of the smoke from the product and reduces the puff count of the smoking product. Additionally, tars from the conceived sheet would have lowered biological activity vs. that of the control.

The HTC material was made by the controlled pyrolysis of a carbohydrate moiety. Instead of making use of alpha-cellulose, mentioned in Example 1, use can be made of other forms of cellulosic materials, such as wood or paper pulp, straw, flax, bamboo, cotton, hemp, rice fibers, other vegetable plants and fibers, and like carbohydrate materials, herein after referred to as cellulosic materials.

The invention here described is equally applicable to any of the tobacco sheet-making processes and is capable of reducing the tar and nicotine contents

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of the smoke from those tobacco products. It is also effective in reducing the puff count.

Background of the Invention

The object of this invention is to prepare smoking products which are formed by treating and combining readily available materials which are low in cost in such a manner as to provide products which have economic advantages over similar-type products now available. It is a method which can be performed in a batchwise or continuous operation.

This invention reduces tars and other smoke components without noticably changing the desirable smoking characteristics of products now available.

More specifically, the smoking material of this invention is comprised of a tobacco component consisting of or comprising a combustible reconstituted tobacco, which smoking material contains a filler intimately incorporated therein and consisting solely or largely of heat-treated carbohydrate (HTC). The HTC employed is pulverized into a finely-divided form and of a particle size less than 250 microns in diameter. Adhesion between the HTC particles and the tobacco is effected without extraneous adhesives and by substances released in slurrying the tobacco used. Preferably, the reconstituted tobacco consists solely or essentially of natural tobacco substances. It may contain added tobacco extract as well as tobacco solids.

Several patents or patent applications cover some of the technology used in the present invention. The right to use some of the inventions covered in some of these patents and patent applications, however, have been made legally available for the use of Philip Morris, Incorporated. They include a series of patents and one patent application not yet issued. These have Theodore S.

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Briskin as the inventor and are assigned to Sutton Research Corporation. These inventions (U. S. 3,861,401; U. S. 3,861,402; and Application Serial No. 367,447) deal with the preparation of a heat-treated cellulosic material in such a manner as to make it suitable as a substitute for tobacco in smoking products. In this present invention, the Briskin-type materials were used to obtain the thermolyzed cellulose.

A patent issued to Roger W. Hedge and assigned to Brown and Williamson Tobacco Corporation (U. S. 3,805,803) relates to the use of carbon as a filler incorporated into the tobacco component of the smoking product.

Another patent (U. S. 3,545,448), with James Forrester Mormon as the inventor and assigned to the Imperial Chemical Industries, Ltd., has as its basis the preparation of a tobacco replacement material from the catalytic degradation of carbohydrate materials.

The prior art cited above does not claim the homogenization of the thermolyzed carbohydrate materials into reconstituted tobacco. The novelty of this invention lies in the fact that this invention accomplishes the incorporation of a thermolyzed carbohydrate into reconstituted tobacco without the addition of other foreign materials which adversely affect the acceptability of the smoking product, provides process and taste improvements and economic advantages, and reduces the tar and nicotine content of the smoke and the puff count.

The greatest tar and nicotine reduction is achieved with the materials that have lost the most weight during the heat treatment of the carbohydrate materials.

Example 1

The heat-treated carbohydrate (HTC) used in this example was formed of

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alpha-cellulose having a thickness of approximately 28.5 mils. The sheet was formed, then put through an oven heated to a temperature of 350°C, and maintained inert by the circulation of nitrogen gas therethrough. The sheet was advanced through the oven at a rate of exposure that would provide a weight loss of 60% while still remaining in sheet form having strong mass integrity. The HTC thus produced was pulverized in preparation for its incorporation into reconstituted tobacco.

The reconstituted tobacco used as the base for the incorporation of HTC can be prepared by any of the well-known reconstituted tobacco processes. For this particular example, the process in a generalized way is given below:

The tobacco parts were cleaned and classified and then dry ground. The tobacco particles were mingled with water and an adhesive. The adhesive was one extracted from tobacco parts.

The resulting mixture was formed into a sheet in the conventional manner for making a reconstituted tobacco sheet. This sheet was cut into four-inch squares and then prepared as is usual for the use of reconstituted tobacco as a cigarette filler. The product was used as the control in the making and testing processes of the materials of this invention. It is designated hereafter as BL in Tables I and II and in Graph I.

For the experimental sheet, the pulverized HTC material described above (60% weight loss after having been heated in a nitrogen atmosphere to 350°C) was added to the BL slurry at the 33.3% level of the thermolyzed material and the slurry was thoroughly mixed. The resulting mixture (designated BL-1) was then cast into sheets as in the usual reconstituted tobacco casting process, dried, and cut into pieces small enough to incorporate with a shredded all-tobacco leaf material into cigarettes.

The control cigarette was composed of 80% of the all-tobacco leaf material and 20% BL. This control is designated as CONTROL in Table I which gives the cigarette specifications and smoking data.

One type of the experimental cigarettes (designated U on Table I) was composed of 75% of an all-tobacco leaf material, 20% BL and 5% of the thermolyzed carbohydrate. The smoking data appears in Table I and is illustrated in Graph I.

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Table 1

Cigarette Specifications and Smoking Data

		Control	U	V
A.	Blend Components (%)			
	All-tobacco Leaf Filler	80	75	70
	BL	20	10	
	BL-1	-	15	30
	*BL-2			
	BL-3			
B.	% HTC in Cigarette	0	5	10
C.	Cigarette:			
	.wts, g/cigt.	1.15	1.02	1.12
	.RTD's inch H_2O	4.2	4.1	4.2
D.	Smoking Data			
	TPM, mg/cigt.	28.3	25.8	23.7
	% reduction		9%	16%
	TPM, H_2O mg/cigt.	3.8	3.2	3.1
	% reduction		16%	18%
	TPM, nicotine, mg/cigt.	1.51	1.36	1.27
	% reduction		10%	16%
	Puff Count	10.9	10.5	10.0
	% reduction		4%	8%
	xxFTC Tar, mg/cigt.	22.99	21.24	19.33
	% reduction		8%	16%
	xxFTC Tar/puff	2.10	2.02	1.93
	% reduction		4%	8%

*The experiments done with the BL-2 compositions were used only for comparison

BL = control
BL-1 = BL with 33.3% HTC (60% wt. loss)
*BL-2 = BL with Pitt Pulverized carbon
BL-3 = BL with HTC (85% wt. loss)

xx FTC is the Federal Trade Commission's approved method for determining tars in cigarette smoke.

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It is to be noted from Table I given above that the TPM, mg/cigt. has been reduced 9% over that of the control; the TPM, H_2O mg/cigt. was reduced 16% over that of the control; the nicotine, mg/cigt. was reduced 10% over that of the control; the reduction in puff count is 4%; the tar, mg/cigt. was reduced 8%; and the tar per puff has a 4% reduction.

Example 2

The ingredients, as in Example 1, were combined in the same manner as in Example 1, except that the heat-treated carbohydrate material was added at the 10% level of the blend which contained 70% of the all-tobacco leaf filler and 30% of the BL that contained the HTC. As can be observed from the portion of Table 1 given above under the tabulations given for V, the TPM, mg/cigt. had a reduction of 16% over that of the control; the TPM, H_2O mg/cigt. had a reduction of 18%; the TPM, nicotine, mg/cigt. had a 16% reduction; the puff count was reduced 8%; the tar, mg/cigt. was reduced 16%; and the tar per puff was reduced 8%.

Example 3

The ingredients, as in Example 1, were prepared and combined in the same manner as in Example 1, except that the heat-treated carbohydrate material was thermolyzed in a slightly reduced oxygen atmosphere to an 85% weight loss. The resulting sheet was used to produce cigarettes designated Y on the portion of Table 2 given below. This cigarette was composed of 75% of an all-tobacco leaf cigarette filler, 20% of BL, and a 5% level of the HTC in the blend.

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Table 2

Cigarette Specifications and Smoking Data

		Control	Y	Z
A.	Blend Components (%)			
	All-tobacco Leaf Filler	80	75	70
	BL	20		
	BL-1		10	
	*BL-2			
	BL-3		15	30
B.	% HTC in Cigarette	0	5	10
C.	Cigarette:			
	.wts, g/cigt.	1.15	1.12	1.12
	.RTD's, inch H_2O	4.2	3.8	4.0
D.	Smoking Data			
	TPM, mg/cigt.	28.3	23.9	22.4
	% reduction		15%	21%
	TPM, H_2O mg/cigt.	3.8	2.9	2.6
	% reduction		24%	32%
	TPM, nicotine, mg/cigt.	1.51	1.34	1.30
	% reduction		11%	14%
	Puff Count	10.9	10.2	10.2
	% reduction		6%	6%
	xxFTC Tar, mg/cigt.	22.99	19.66	18.5
	% reduction		14%	19%
	xxFTC Tar/puff	2.10	1.93	1.81
	% reduction		8%	14%

*The experiments done with the BL-2 compositions were used only for comparison.

BL = control
BL-1 = BL with 33.3% HTC (60% wt. loss)
*BL-2 = BL with Pitt Pulverized carbon
BL-3 = BL with HTC (85% wt. loss)

xxFTC is the Federal Trade Commission's approved method for determining tars in cigarette smoke.

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It will be noted from Table 2 that the reductions of the constituents of the total particulate matter were substantially reduced over those of the control.

Example 4

The ingredients as in Example 1, were combined in the same manner as in Example 1, except that the heat-treated carbohydrate material was thermolyzed in a slightly reduced oxygen atmosphere to an 85% weight loss. The resulting sheet was used to make the cigarettes designated Z in Table 1. This cigarette was composed of 70% of an all-tobacco leaf material and 30% of the BL material which contained the thermolyzed material, which gave 10% of HTC in the blend. As will be observed from Table 2, substantial increases in the reduction of the components of total particulate matter were realized over those of the control and over those of the other experimental cigarettes prepared by the methods of this invention. Therefore, the HTC which had the greatest weight loss during thermolyzation produced the highest reduction in the components of total particulate matter, especially so for the reduction of tar, nicotine, and puff count.

Example 5

For purposes of comparison, activated carbon such as that supplied by Pittsburgh Carbon Company was incorporated into reconstituted tobacco prepared as described in Example 1.

For the experimental sheet, the activated carbon described above was added to the BL slurry at the 33.3% level of the carbon and the slurry was thoroughly mixed. The resulting mixture (designated BL-2) was then cast into sheets as in

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the usual reconstituted tobacco casting process, dried, and cut into pieces small enough to incorporate with a shredded all-tobacco leaf material into ci cigarettes.

The control cigarette was composed of 80% of the all-tobacco leaf material and 20% BL. This control is designated as CONTROL in Table 1 which gives the cigarette specifications and smoking data.

One type of the experimental cigarettes (designated W in Table 3) was composed of 75% of an all-tobacco leaf material, 20% BL, and 5% of the activated carbon material. The smoking data appears in Table 3 and is illustrated in Graph 1.

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Table 3

Cigarette Specifications and Smoking Data

	Control	W	X
A. Blend Components (%)			
All-tobacco Leaf Filler	80	75	70
BL	2020	10	
BL-1			
*BL-2		15	30
BL-3			
B. % Activated Carbon in Cigarette		5	10
C. Cigarette:			
.wts, g/cigt.		1.12	1.12
. RTD's, inch H_2O		3.9	4.0
D. Smoking Data			
TPM, mg/cigt.	28.3	23.8	22.0
% reduction		16%	22%
TPM, H_2O mg/cigt.	3.8	3.2	2.5
% reduction		16%	34%
TPM, nicotine, mg/cigt.	1.51	1.31	1.17
% reduction		13%	25%
Puff Count	10.9	10/2	9.9
% reduction		8%	9%
xxFTC Tar, mg/cigt.	22.99	19.29	18.33
% reduction		16%	20%
xxFTC Tar/puff	2.10	1.89	1.85
% reduction		10%	12%

*The experiments done with the BL-2 compositions were used only for comparison.

BL = control
BL-1 = BL with 33.3% HTC (60% wt. loss)
*BL-2 = BL with Pitt Pulverized carbon
BL-3 = BL with HTC (85% wt. loss)

xxFTC is the Federal Trade Commission's approved method for determining tars in cigarette smoke.

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Example 6

The ingredients of the experimental cigarette, as in Example 1, were combined in the same manner as in Example 1, except that the activated carbon material was added at the 10% level of the blend which contained 70% of the all-tobacco leaf filler and 30% of the BL that contained the activated carbon. As can be observed from the portion of Table 3 given above under the tabulations of reductions given for X, had a TPM, mg/cigt. of 22%; TPM, H_2O/cigt. of 34%; TPM, nicotine/cigt. of 23% Puff count/cigt. of 9%; FTC Tar, mg/cigt. of 20%; and FTC Tar/puff of 12%. This data has been tabulated for comparison purposes only.

As can be seen from the comparison of the data obtained by using activated carbon versus partially thermolyzed carbohydrate (at the 85% weight loss level), the reduction in the smoke components at the levels used are virtually the same. However, the thermolyzed carbohydrate gives additional advantages to the processibility and the physical characteristics of the reconstituted tobacco and the smoking product.

Any further developments in the incorporation of heat-treated carbohydrates in reconstituted tobacco products will be reported and will become a part of this disclosure.

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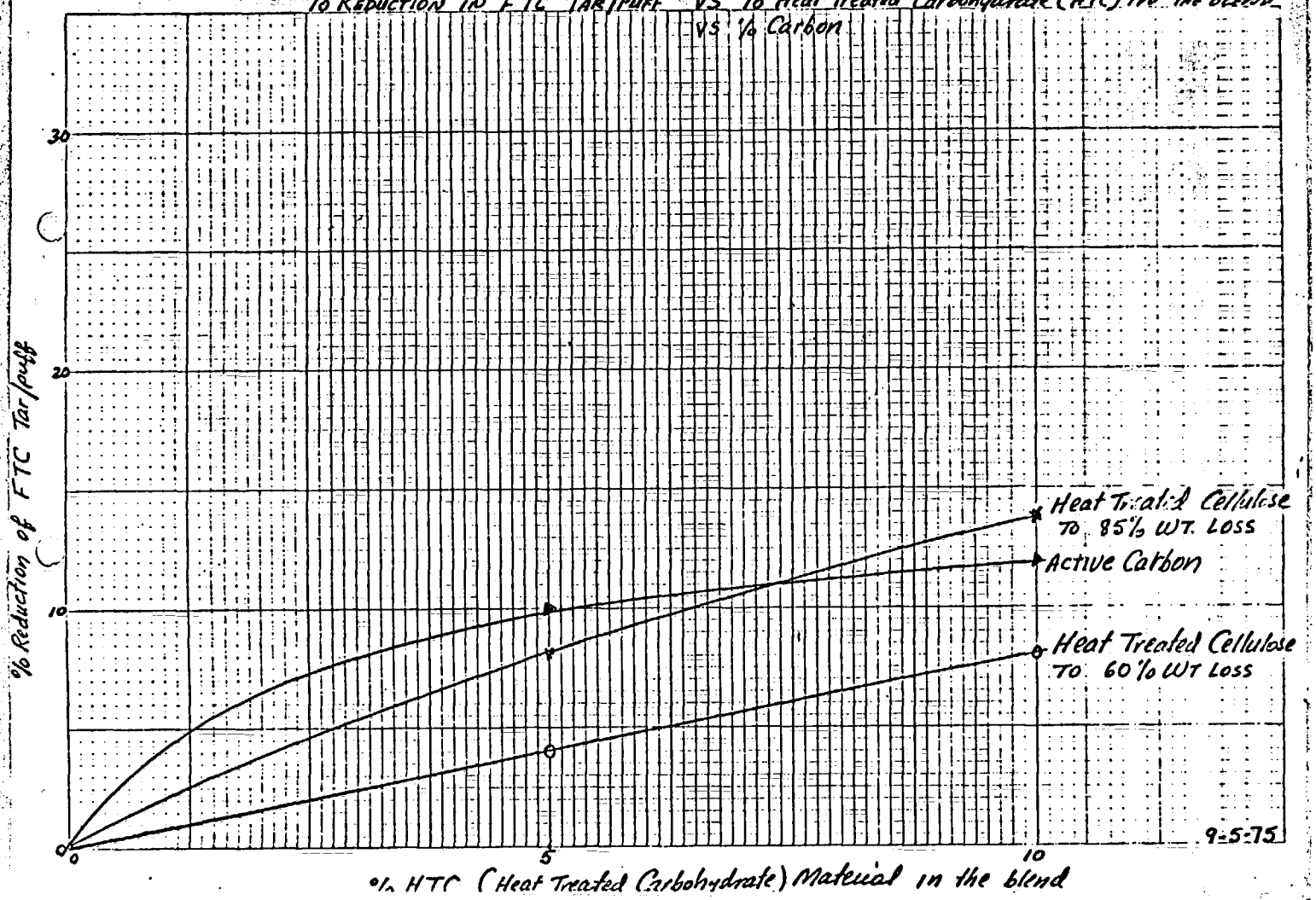
GRAPH 1

SMOKING DATA

% REDUCTION IN FTC TAR/PUFF VS % HEAT TREATED CARBOHYDRATE (HTC) IN THE BLEND VS % CARBON



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